In the Claims:

1. (Previously Presented) A method for producing insulator structures in a semiconductor substrate, comprising:

introducing insulator trenches into the semiconductor substrate from a substrate surface of the semiconductor substrate; and

partially filling the insulator trenches with a main layer made of an additive-doped insulator material in the course of an HDP deposition process based on a high density plasma,

wherein in the course of the HDP deposition process and in a common process chamber:

first a predeposition process in which silane and oxygen are supplied as chemical precursor compounds is controlled with exclusion of halogens or halogen compounds and an additional layer of the insulator structure is produced,

then a barrier layer, which blocks an interaction of the additive with the semiconductor substrate, is produced before a deposition of the main layer, and

after production of the main layer, an auxiliary deposition process is controlled with exclusion of halogens or halogen compounds and a termination layer of the insulator structure is provided.

2. (Canceled)

3. (Previously Presented) The method of claim 1, wherein the predeposition process of the additional layer, the production of the barrier layer and a main deposition process relating to the main layer are controlled successively and in common process chamber.

4. (Original) The method of claim 3, wherein a halogen or a halogen compound is provided

as the additive.

5. (Original) The method of claim 4, wherein the fluorine or a fluorine compound is provided as the halogen.

6. (Original) The method of claim 5, wherein silicon oxide is provided as the insulator material.

7. (Canceled)

8. (Previously Presented) The method of claim 1, wherein material deposited above the substrate surface in the course of the HDP deposition process is caused to recede as far as the substrate surface.

9. (Previously Presented) The method of claim 1, wherein p-channel transistors are provided outside the insulator structures in the area of the substrate surface.

10. (Canceled)

11. (Previously Presented) The method of claim 1, wherein silane, oxygen and NF_3 are supplied as chemical precursor compounds in the course of the deposition of the main layer.

12. (Previously Presented) The method of claim 11, wherein the material of the barrier layer is selected from a group consisting SiN, SiON, SiC, SiOC, amorphous silicon and nitrided

silicon oxide.

13. (Previously Presented) The method of claim 11, wherein the material of the barrier layer comprises SiN and wherein silane and N_2 are supplied as precursors for the production of the barrier layer.

14. (Previously Presented) The method of claim 1, wherein the insulator trenches are provided with an aspect ratio of greater than 5:1.

15-21. (Canceled)

22. (Previously Presented) The method of claim 1, wherein a halogen or a halogen compound is provided as the additive.

23. (Previously Presented) The method of claim 22, wherein the fluorine or a fluorine compound is provided as the halogen.

24. (Previously Presented) The method of claim 1, wherein the material of the barrier layer comprises silicon and nitrogen.

25. (Previously Presented) A method for producing a trench insulating structure, the method comprising:

providing a semiconductor body that includes a trench;

forming a first oxide layer in the trench by chemical vapor deposition;

forming a barrier layer over the first oxide layer;

forming a halogen doped insulation layer over the barrier layer, the halogen doped insulation layer formed by a high density plasma process; and

forming an undoped oxide layer over the halogen doped insulation layer;

wherein the first oxide layer, the barrier layer, the halogen doped insulation layer and the undoped oxide layer are formed in a single process chamber.

26. (Previously Presented) The method of claim 25, wherein the halogen doped insulation layer comprises a layer doped with fluorine or a fluorine compound.

27. (Previously Presented) The method of claim 25, wherein the material of the barrier layer is selected from a group consisting SiN, SiON, SiC, and SiOC.

28. (Previously Presented) The method of claim 25, wherein the material of the barrier layer is selected from a group consisting amorphous silicon and nitrided silicon oxide.

29. (Previously Presented) The method of claim 25, wherein the material of the barrier layer comprises SiN and wherein forming the barrier layer comprises supplying silane and N_2 as precursors.

30. (Previously Presented) The method of claim 25, wherein the trench has an aspect ratio of greater than 5:1.

31. (New) A method for producing insulator structures in a semiconductor substrate, comprising:

introducing insulator trenches into the semiconductor substrate from a substrate surface of the semiconductor substrate; and

partially filling the insulator trenches with a main layer made of an additive-doped insulator material in the course of an HDP deposition process based on a high density plasma,

wherein a barrier layer, which blocks an interaction of the additive with the semiconductor substrate, is produced before a deposition of the main layer in the course of the HDP deposition process.

32. (New) The method of claim 31, wherein in the course of the HDP deposition process, before the deposition of the barrier layer, a predeposition process is controlled with exclusion of halogens or halogen compounds and an additional layer of the insulator structure is produced.

33. (New) The method of claim 32, wherein the predeposition process of the additional layer, the production of the barrier layer and a main deposition process relating to the main layer are controlled successively and in a common process chamber.

34. (New) The method of claim 31, wherein a halogen or a halogen compound is provided as the additive.

35. (New) The method of claim 34, wherein fluorine or a fluorine compound is provided as the halogen.

36. (New) The method of claim 34, wherein silicon oxide is provided as the insulator material.

37. (New) The method of claim 36, wherein in the course of the HDP deposition process, after the production of the main layer, an auxiliary deposition process is controlled with exclusion of halogens or balogen compounds and a termination layer of the insulator structure is provided.

38. (New) The method of claim 31, wherein material deposited above the substrate surface in the course of the HDP deposition process is caused to recede as far as the substrate surface.

39. (New) The method of claim 31, wherein p-channel transistors are provided outside the insulator structures in the area of the substrate surface.

40. (New) The method of claim 31, wherein silane and oxygen are supplied as chemical precursor compounds in the course of the predeposition process.

41. (New) The method of claim 40, wherein silane, oxygen and NF_3 are supplied as chemical precursor compounds in the course of the main deposition process.

42. (New) The method of claim 31, wherein the material of the barrier layer is selected from a group comprising Si--N, Si--O--N, Si--C, Si--O--C, amorphous silicon and nitrided silicon oxide.

43. (New) The method of claim 42, wherein Si--N is selected as the material of the barrier layer and silane and N_2 are supplied as precursors for the production of the barrier layer.

44. (New) The method of claim 31, wherein the insulator trenches are provided with an aspect ratio of greater than 5:1.